Technical Reference Manual Hardware and BIOS

HP Vectra XU 6/xxx PC
and
HP Vectra VT 6/xxx PC

January 1996

Table of Contents

NOTICE

Information contained in this document is subject to change without notice.

Hewlett-Packard makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Hewlett-Packard assumes no responsibility for the use or reliability of its software on equipment that is not furnished by Hewlett-Packard.

PREFACE

This manual is a technical reference and BIOS document for engineers and technicians providing system level support. It is assumed that the reader possesses a detailed understanding of AT-compatible microprocessor functions and digital addressing techniques.

Technical information that is readily available from other sources, such as manufacturer’s proprietary publications, has not been reproduced.

This manual contains summary information only. For additional reference material, refer to the bibliography.

CONVENTIONS

The following conventions are used throughout this manual to identify specific elements:

- Hexadecimal numbers are identified by a lower case h.
  For example, 0FFFFFFFh or 32F5h

- Binary numbers and bit patterns are identified by a lower case b.
  For example, 1101b or 10011011b

BIBLIOGRAPHY

- HP Vectra XU 6/xxx PC *User's Guide* manual kit (D3538A).
- HP Vectra VT 6/xxx PC *User's Guide* manual kit (D3539A).
- HP Vectra XU 6/xxx PC and HP Vectra VT 6/xxx PC *Familiarization Guide* (D3538-90901).
- HP Vectra *Accessories Service Handbook - 5th edition* (5963-8034).
- HP Vectra *PC Service Handbook (Volume 1) - 9th edition* (5963-8033).
- *HP 10/100 VG Selectable PC LAN Adapters Installation Guide* (5963-2665).
- *XU/VT Drivers and Documentation* CD-ROM (5063-7925).
- *Support Assistant* CD-ROM.

The following Intel® publication provides more detailed information:

- *Pentium Pro Processor Data Sheet* (242769-001)

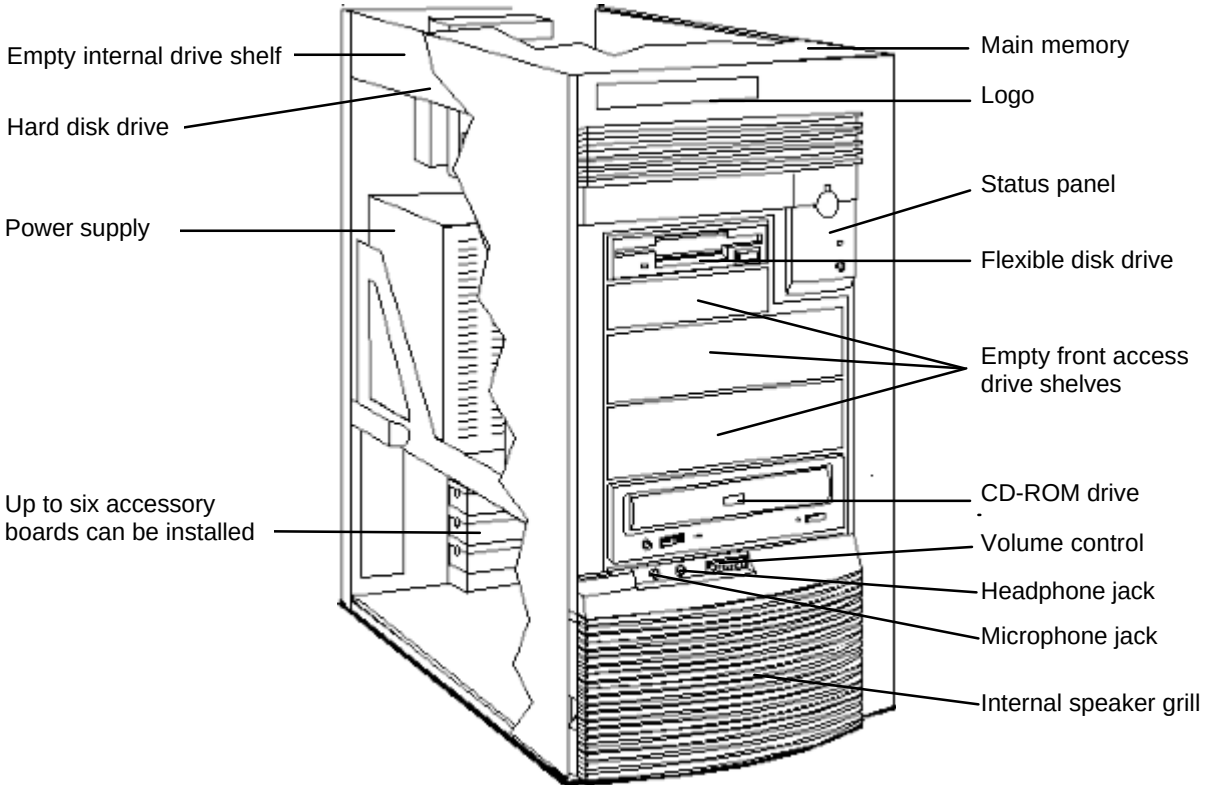
1 SYSTEM OVERVIEW

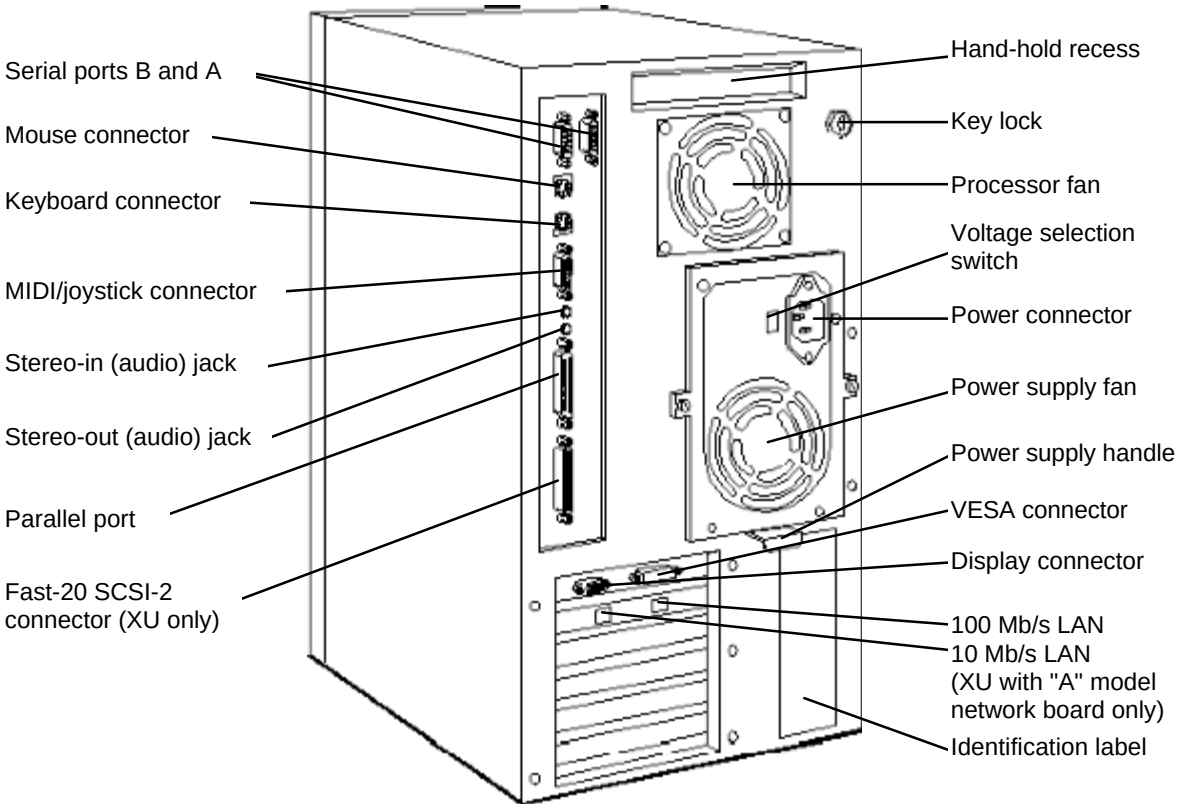
This manual describes the *HP Vectra XU 6/xxx PC* and *HP Vectra VT 6/xxx PC*, and provides detailed system specifications.

This chapter introduces the external features, and lists the specifications and characteristic data of the system. It also summarizes the documentation which is available.

EXTERNAL FEATURES

The following two diagrams show the front and rear views of the *HP Vectra XU 6/xxx PC* with an "A" model network board. The *HP Vectra VT 6/xxx PC* is similar, but has no SCSI or LAN connectors.





INTERNAL FEATURES

Both models of PC are constructed around the Peripheral Component Interconnect (PCI) bus and Industry Standard Architecture (ISA) bus. They are the first members of the HP Vectra PC family to use the Intel Pentium Pro (P6) processor.

Since there is no back-plane, the system board diagram, at the beginning of the next chapter, shows the locations of all the PC's main field-serviceable components. The components of the system board are described in Chapter 2; the characteristics of the PC's video, disk and networking devices are described in Chapter 3. The HP BIOS routines are described in Chapter 4; and the Power-On Self-Test routines are summarized in Chapter 5.

SPECIFICATIONS AND CHARACTERISTIC DATA

Status (Control) Panel

The status (control) panels of the *HP Vectra XU 6/xxx PC* and *HP Vectra VT 6/xxx PC* have the following features:

- a power on/off button with integrated on/error status light
- a *press-and-hold* RESET button
- a hard disk activity light.

PHYSICAL CHARACTERISTICS

System Processing Unit	
Weight:	33 lbs (15 kg)
Dimensions:	15.95 inches (D) by 8.27 inches (W) by 16.34 inches (H) (40.5 cm by 21 cm by 41.5 cm)
Footprint:	0.91 sq ft (0.085 m^2)
Keyboard:	18 inches (W) by 7 inches (D) by 1.3 inches (H), when flat, or 18 inches (W) by 7 inches (D) by 2 inches (H), when standing (464mm by 178mm by 33mm when flat, or 464mm by 178mm by 51mm, when standing)

ELECTRICAL SPECIFICATION

Parameter	**Total Rating**		Notes	Typical per PCI Accessory Slot	Typical per ISA Accessory Slot
Input voltage	100-127 Vac	200-240 Vac	Switch selectable		
Input current (max)	6 A	3.15 A			
Input power (max)	280 W		Less than 5 W when turned off		
Input frequency	47 Hz to 63 Hz				
Heat dissipation	280 W				
Available power	200 W			15 W (max)	15 W (max)
Max current at +12 V	4 A		—	0.2 A	0.2 A
Max current at -12 V	0.5 A		—	0.2 A	0.5 A
Max current at +3.3 V	16 A		Together, these two must not exceed 145 W*	These must not exceed 2.5 A per slot	—
Max current at +5V	29 A				1 A
Max current at -5V	0.2 A		—	—	0.2 A
Max current at +5Vst	70 mA		—	—	—

*Since 29 A at 5 V equates to 145 W, it follows that for every 1 A that is required from the 3.3V supply, it is necessasry to reduce the 29 A limit on the 5 V supply by 0.66 A. For example, 3A at 3.3 V plus a maximum of 27 A at 5 V, or 6 A at 3.3 V plus a maximum of 25 A at 5 V.

An attempt to draw too much current (such as a short circuit across edge-connector pins, or an accessory board that is not suitable for these PCs), will cause the overload protection in the power supply to be triggered, and the PC could fail to boot.

ENVIRONMENTAL SPECIFICATIONS

Environmental Specifications (System Processing Unit, with Hard Disk)	
Operating Temperature	+ 40°F to 104° F (+5°C to +40°C)
Recommended Operating Temperature	+59°F to +158°F (+15°C to +30°C)
Storage Temperature	-40°F to +158°F (-40°C to +70°C)
Over Temperature Shutdown	+122°F (+50°C)
Operating Humidity	15% to 80% (relative)
Storage Humidity	8% to 80% (relative)
Acoustic noise emission	less than 40 dB in the workplace under normal conditions as defined by DIN 45635 T.19 and ISO 7779
Operating Altitude	10000 ft (3100m) max
Storage Altitude	15000ft (4600m) max

Operating temperature and humidity ranges may vary depending upon the mass storage devices installed. High humidity levels can cause improper operation of disk drives. Low humidity levels can aggravate static electricity problems and cause excessive wear of the disk surface.

DOCUMENTATION

The table below summarizes the availability of the documentation that is appropriate to the *HP Vectra XU 6/xxx PC* and *HP Vectra VT 6/xxx PC*. Three dots, '...', are used to indicate 'XU' or 'VT', as appropriate.

Only selected publications are available in paper-based form. Most are available as printable files from the HP regional support servers, or from the *Support Assistant* CD-ROM.

Title	Regional Support Servers		Support Assistant CD-ROM		Paper-based	
Line of HPVectra 6/xxx PC:	XU	VT	XU	VT	XU	VT
HP Vectra ... 6/xxx User's Guide	yes	yes	yes	yes	D3538A	D3539A
Optimizing Performance Guide	yes	no	yes	no		no
HP Vectra XU/VT 6/xxx Familiarization Guide	yes		yes		D3538-90901	
HP Vectra XU/VT 6/xxx Technical Reference Manual	yes		yes		no	
HPVectra PC Service Handbook (9th Edition)	yes	yes	yes	yes	5963-8033	
HPVectra Accessory Service Handbook (5th Edition)	yes		yes		5963-8034	
Network Administrators Guide	WinHelp, HTML and text formats	not applicable	yes	not applicable	no	not applicable
HP 10/100 VG Selectable PC LAN Adapters	yes	not applicable	yes	not applicable	5963-2665	not applicable
Matrox MGA Millennium	no		no*		no	

*Available on the XU/VT Drivers and Documentation CD-ROM

WHERE TO FIND THE INFORMATION

The table below summarizes the availability of information within the documentation:

	User Guide	User Online	Performance Guide	Familiarization Guide	Service Handbook	Technical Reference Manual
Introducing the PC						
Product features	Key features	Exploring		New features Vectra PC comparison	Exploded view Parts list	Key features
Product model numbers				Product range	Product range CPL dates	Product range
Using the PC						
Connecting cables and turning on	Keyboard, mouse, display, network, printer, power					
Finding on-line information	Finding READ.MEs and on-line documentation					
Environmental	Setting up the PC	Working in comfort				
Formal documents	License agreement Warranty information	License agreement				
Upgrading the PC						
Opening the PC	Full details					
Supported accessories	Full PN details			Full PN details	Full PN details	
Installing accessories	How to install		Why to install	New procedures		
Configuring devices	Installing drivers	Configuring peripherals				
Fields and their options within *Setup*	Key fields			New fields		Complete list
Repairing the PC						
Troubleshooting	Basic			Repair policy	Service notes	Advanced
Technical information	Basic		Advanced	Basic		Advanced
System board	Jumpers, switches and connectors			Jumpers, switches and connectors How to replace	Jumpers, switches and connectors	Jumpers, switches and connectors Chip-set details
BIOS	Basic details			New features		Technical details Memory maps

Power-On Self-Test routines (POST)	Key error codes and suggestions for corrective action			New features		Error codes and suggestions for corrective action Order of tests
Vectra diagnostic utility				New features		Technical details
Peripheral Devices						
Display User's Guide	Setting up and configuring					
Disk drive User's Guide	Setting up and configuring					
Audio User's Guide	Setting up and configuring					
LAN Administrator's Guide	Setting up and configuring					

2 SYSTEM BOARD

The next chapter describes the video, disk and network devices which are supplied with the PC.

This chapter describes the components of the system board. An overview of the system board is first given. Then the components of the Processor-Local Bus, the PCI Bus and the ISA Bus are described in more detail.

PRINCIPAL COMPONENTS AND FEATURES

The system board contains the following components:

PGA ZIF sockets

Each processor is packaged in a 387-way *pin-grid-array* (PGA), which is seated on the system board in a *zero-insertion-force* (ZIF) *socket*. The *HP Vectra XU 6/xxx PC* has two such sockets: the top one is occupied by the Pentium Pro (P6) processor; the bottom one is empty, and can be filled with an optional second Pentium Pro processor. The *HP Vectra VT 6/xxx PC* has one socket, occupied by the Pentium Pro processor, with no option for fitting a second Pentium Pro processor.

VRM sockets

The *voltage regulator module* (VRM) is capable of supplying a voltage of 1.5 V to 3.5 V. This voltage is selected automatically, and depends on the needs of each processor. For instance, the 150 MHz Pentium Pro requires 3.1 V, whilst the 200 MHz version requires 3.3 V. There are two VRM sockets on the *HP Vectra XU 6/xxx PC* (one of which is already occupied), and one on the *HP Vectra VT 6/xxx PC*.

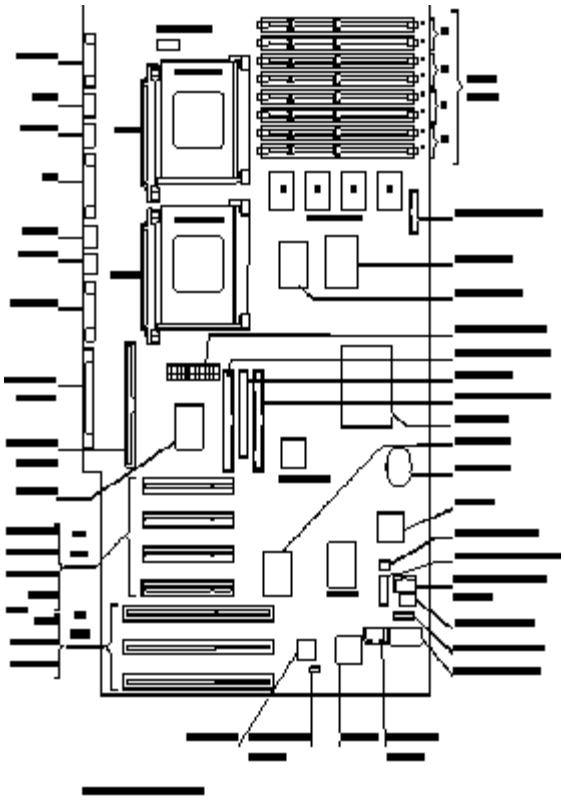
Accessory Slots

There are three *accessory slots* on the PCI bus, two on the ISA bus, and one that lies on either bus. Thus there are four PCI accessory sockets, and three ISA bus accessory sockets. The top PCI bus slot is already occupied by the Matrox MGA Millennium video controller. On the *HP Vectra XU 6/xxx PC*, the second PCI slot is also already occupied, by the HP PCI Integrated 10/ 100 VG Interface. (These two boards are described in the next chapter).

System Board Switches

The first three of the *system board switches* set the configuration for the PC, as summarized in the table below. The next two set the frequency of the Processor-Local bus, and the last three the ratio of processor-frequency to Processor-Local-bus-frequency.

Switch:	Function:	OFF (default)	ON
1 - CONFG	Retain or clear the configuration which is stored in EEPROM	Retain	Clear
2 - PSWRD	Enable or clear the User and System Administrator Passwords which are stored in EEPROM	Enable	Clear
3 - SECURE	Security mode prevents changes to the PC's configuration with the *Setup* program	Disable	Enable
4, 5, 6, 7, 8	Processor bus frequencies (see the table on page 15)		



Wavetable Interface Connector

This is used when installing a Creative Labs wavetable accessory board that operates with the integrated SoundBlaster audio interface.

Main Memory Module Sockets

There are eight *main memory module sockets*, arranged in four banks(A to D). One bank is already occupied by the pair of *double interline memory modules* (DIMMs) that contain the 16 MB of memory that is fitted as standard on all models of the PC.

SCSI Controller and Connector

An *Ultra SCSI controller*, on PCI bus of the *HP Vectra XU 6/xxx PC*, supports *Fast-20 SCSI-2*. Internal and external connectors are provided.

IDE Controller and Connector

The Enhanced IDE (EIDE) controller chip can be found next to the IDE connectors. Connected to the PCI bus, it has IDE-Master capability. It has two channels, each capable of supporting two devices: a primary channel (recommended for EIDE, or IDE, hard disk drives, using the grey connectors); a secondary channel (recommended for EIDE, or IDE, CD-ROM drives, using the red connectors).

Ultra I/O Chip

The *Ultra I/O* chip is located just slightly above and to the right of the ISA slots. It is a combined controller on the ISA bus for the flexible disk drive connector, and for the one parallel and two serial communications ports.

Audio Chip

The *SoundBlaster 16* chip is located to the right of the Ultra I/O chip, near the bottom right hand edge of the board. This provides the audio interface, and is driven from the ISA bus.

Chip-Set

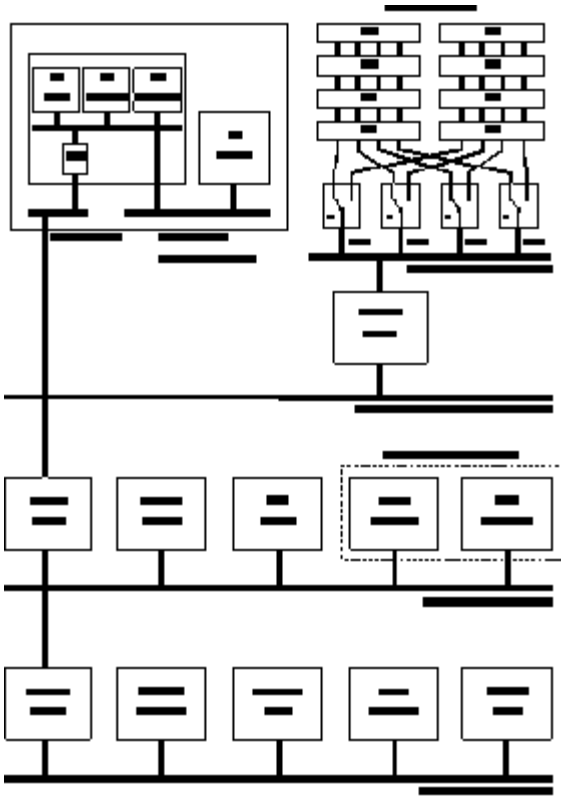
The *Intel 82450KX chip-set* comprises eight chips. Six of them are concerned with controlling memory accesses, and are located below the memory module sockets. These are the four datapath units, the memory controller chip, and the Mem/PL bridge chip. They are described in the sub-section of this chapter entitled “Main Memory”. The remaining two chips are the PL/PCI bridge chip, which is described in the section entitled “Devices on the PCI Bus”, and the PCI/ISA bridge chip, which is described in the section entitled “Devices on the ISA Bus”.

Gold Capacitor

A *Gold Capacitor* is provided instead of a battery, and can store enough energy to power the CMOS configuration memory for over a week after the mains power has been disconnected.

Architectural View

The following block diagram gives an architectural view of the *HP VectraXU 6/150 PC*. The next section describes the devices on the system board which are associated with the Processor-Local (PL) bus. The section after describes the devices on the system board that are associated with the Peripheral Component Interconnect (PCI) bus. The final section describes the devices on the system board that are associated with the Industry Standard Architecture (ISA) bus.



DEVICES ON THE PROCESSOR-LOCAL BUS

The following subsystems are associated with the Processor-Local bus:

- Intel Pentium Pro (P6) microprocessor
- cache memory
- optional second microprocessor (*HP Vectra XU 6/xxx PC* only)
- main memory.

INTEL PENTIUM PRO (P6) MICROPROCESSOR

Apart from the two levels of cache memory, contained within the processor's single integrated package, the other new features of the Pentium Pro are:

- three-way super-scalar pipeline (versus two for the Pentium)
- five execution units (versus three for the Pentium)
- 12 stage super-pipeline (versus 5 stage pipeline for the Pentium)
- dynamic, out-of-order, speculative execution
- 16-state, dynamic multiple branch prediction
- split-transaction bus
- register renaming.

Although it is not pin compatible with the Pentium, the Pentium Pro is backward code-compatible. Software written for previous HP Vectra models will run on the Pentium Pro-based HP Vectras. However, only 32-bit programs execute faster. 16-bit programs might even only execute at the speed that would have been attained by an equivalent 80486-based system.

Many techniques have been adopted to accelerate the throughput of the instruction-pipeline of the Pentium Pro over that of the Pentium. Firstly, it is *super-pipelined*: the individual operations of the Pentium pipeline have been broken down into many sub-operations, leading to a much longer pipeline of smaller operations. Secondly, it is *super-scalar*: the five execution units are completely independent; not only can they have instructions issued to them asynchronously of each other, but they can complete their execution asynchronously of each other, too.

Since instructions can complete asynchronously, it is possible for a simple instruction to complete before a complex one which precedes it. This is the first of two ways in which the Pentium Pro manifests *out-of-order instruction execution*. The second way follows as a direct result of the *speculative execution* feature: whilst a time-consuming instruction is still awaiting completion, the processor gets on with executing instructions that were fetched after it, on the speculation that they will probably be needed next.

Related to this, the Pentium Pro incorporates an even more elaborate (and more accurate) 16-state *dynamic branch prediction* mechanism than the one which is used on the Pentium. This allows the processor to speculate as to which instructions will be needed following a conditional branch, based on past behavior at the branch.

A module, known as the *re-order buffer* (ROB), handles the out-of-order completion of instructions, and the cases where speculative execution proves to have been wrong (a misprediction by the branch prediction unit, for example).

System Board Switch Speed Settings

Like the Pentium and 80486 DX2 processors, the Pentium Pro uses internal clock multiplication. For example, the Pentium Pro 150 MHz processor multiplies the 60 MHz system clock by 2.5. Switches 4 and 5 on the system board switch bank set the frequency of the Processor-Local bus. Switches 6, 7 and 8 set the clock multiplier ratio. The relationship of the switch settings to Processor-Local bus and processor frequencies is summarized in the following table:

Switch 4	Switch 5	Processor Local Bus Frequency	Switch 6	Switch 7	Switch 8	Frequency Ratio Processor : Local Bus	Processor Frequency
Off	Off	66 MHz	Off	Off	Off	2 : 1	133 MHz*
On	Off	60 MHz	On	Off	Off	2.5 : 1	150 MHz
Off	Off	66 MHz	On	Off	Off	2.5 : 1	166 MHz
On	Off	60 MHz	Off	On	Off	3 : 1	180 MHz
Off	Off	66 MHz	Off	On	Off	3 : 1	200 MHz

*The 133 MHz PentiumPro processor is not supplied in any of the Vectra models. This information is provided for completeness only.

CACHE MEMORY

There are two integrated circuits sealed within a single Pentium Pro package. One of these contains the Level-2 (L2) cache memory chip; the other contains the processor, which includes two banks of Level-1 (L1) cache memory.

Each L1 cache memory has a capacity of 8 KB, and is set-associative. The L2 cache memory has a capacity 256 KB, and is four-way set-associative.

Data is stored in the cache memories in lines of 32-bytes (256 bits). This involves two consecutive transfers of 128-bits with the main memory.

The Pentium Pro processor guards against *cache coherency* problems by monitoring the accesses to the memory which are made by other PC devices (including DMA controllers, and a second processor, if installed) through a mechanism known as *bus snooping*. Associated with each cache line are two status bits which define the *MESI* state (modified, exclusive, shared or invalid) of the cache line.

The amount of cached memory is set by Intel, at the time of manufacture, so cannot be changed. It is anticipated that Intel will offer new versions of the Pentium Pro (P6) processor with 512 KB of L2 cache memory. Upgrading the processor will then become possible as the means for changing the amount of cache memory.

Extending the amount of cache memory can never have a detrimental effect on the performance. However, it *can* experience a law of diminishing returns, so that extending the cache memory does not have a cost-effective impact on the performance. Finding the correct amount to install is an empirical process, either by simulation, or by trial and error on the real hardware.

PROCESSOR-LOCAL BUS

The Processor-Local bus of the *HP Vectra XU 6/150 PC* and *HP Vectra VT 6/150 PC* is 64 bits wide, and is clocked at 60 MHz. Although carrying 64-bits of data, it is in fact composed of 141 signals. These are implemented using Intel's GTL+ technology. To reduce voltage over- and under-shoots, the signals are clamped to a 0 to 1.5 voltage range (with 60 mA per signal), and are filtered to prevent the logic edges from becoming too steep (that is, there is a minimum constraint on the rise and fall times, as well as the usual maximum constraint).

The bus is implemented as a *split-transaction bus*. A device (such as the Pentium Pro processor) can send a request (such as asking for the contents of a given memory address) and, rather than waiting for the result, it can release the bus, to get on with other work. The target device then requests the bus when it is ready to respond, and sends the requested data packet. Up to eight transactions are allowed to be outstanding at any given time.

OPTIONAL SECOND MICROPROCESSOR

The support of Intel's *Advanced Priority Interrupt Controller* (APIC), the split-transaction bus, and the integrated L2 cache (which dispenses with the need for a proprietary bus to communicate among processors) ideally suits the Pentium Pro for the construction of multiprocessor systems. As many as four of them can be directly connected together, without the need for extra glue logic. At present, however, the *HP Vectra XU 6/xxx PC* only allows for dual processing capability.

Not all operating systems support a second processor. Of those that do, not all uses of them increase the performance. Installing a second processor is only advantageous when the software can make use of parallel activity. In particular, you need to be running a multi-threaded operating system that supports multiprocessing (one that is *MPS-ready*), such as SCO-Unix, NextStep, Solaris, OS/2 SMP and Windows NT. Of these, the Windows NT operating system makes best use of the Pentium Pro's 32-bit architecture (though other operating systems will also show some benefit if 32-bit application programs are run). This is covered in the *Guide to Optimizing Performance on the HP Vectra XU 6/xxx PC*, and is summarized in the following table.

	SCO Unix	**Next Step**	**Sunsoft Solaris**	**OS/2**	**Windows NT 3.5 (or greater)**	**Windows 95**	**Windows 3.x**	**DOS**
Multi-threaded	Yes	Yes	Yes	Yes	Yes	Yes	No	No
MPS-ready	Yes	Yes	No	No	Yes	No	No	No
32-bit operating system	Yes	Yes	Yes	Yes	Yes	Partial*	No	No

32-bit applications available	Yes	Yes	Yes	Yes	Yes	Yes	Partial**	No

*32-bit operation at the outermost levels, but only 16-bit working internally
**With the 32S library

The two processors must be operating at the same bus speed and the same processor speed, with the switch settings set accordingly, otherwise erroneous operation will result.

MAIN MEMORY

The *HP Vectra XU/VT 6/xxx PCs* use *fast page-mode* (FPM) DRAM, not *extended data-out* (EDO) DRAM.

The modules are organized in pairs so that a request for a transaction to or from the L2 cache memory will cause two consecutive blocks of 16 bytes (128 bits) to be accessed. Rather than accessing all 128 bits simultaneously, the 64-bit data bus is used more efficiently by *interleaving* two accesses, the first to one half of the memory bank (for example, A1/B1/C1/D1), the second to the other (for example, A2/B2/C2/D2).

Although each memory module stores a line of 64 bits of data (8 bytes), each ECC memory module of the *HP Vectra XU 6/xxx PC* is, in fact, serviced by a 72-bit Intel proprietary memory bus. The extra bits are generated by the Mem/PL Bridge chip, and are used to implement the *error correcting code* (ECC). A subsequent error in a memory bit can be corrected, by referring to these extra bits, and hence neither causes the data to be lost, nor corrupted, nor the computation to be aborted (as would have been the case with simple parity detection, as on the *HP Vectra XU 5/xx PC*).

Chip-Set Chips that are involved in Memory Access

The Mem/PL Bridge chip (OMC-DP) is an Intel 82452KX. It interfaces between the Processor-Local (PL) bus, whose datapath is 64-bits wide, and the Intel proprietary memory bus, whose datapath is 72-bits wide. During a memory-write operation, on the *HP Vectra XU 6/xxx PC*, the chip generates 8 ECC parity bits. During a memory-read operation, the chip regenerates the 64 data bits from the 72-bit bus, applying error correction when appropriate.

Each of the four datapath chips (the Memory Interface Chips, MIC) is an Intel S82451KX, and acts as a two-way switch, able to connect alternately to the A1,B1,C1,D1 side of the interlaced memory, or the A2,B2,C2,D2 side. Since only an 18-bit path can be handled, four units are needed. Datapath units 1, 2, 3 and 4, handle bits 0..17, 18..35, 36..53 and 54..71, respectively.

Finally, the memory controller chip (OMC-DC) is an Intel S82453KX. It is responsible for decoding the signals on the address and control paths from the Processor-Local (PL) bus, and for generating the appropriate control signals for the memory banks (such as RAS, CAS, WE# and the address lines).

Error Correcting Code Operation

The *HP Vectra XU 6/xxx PC* can tolerate as many as one faulty memory bit per 64-bit line of instruction or data words. The erroneous bit is corrected (automatically and transparently) by the hardware. The computer program continues to execute as if no error had occurred.

If two, or more, bits are faulty within any given 64-bit line, the effect is the same as it would have been without error correction. The effect of executing a faulty instruction is always unpredictable, and might cause the program to ‘hang’. The effect of reading a faulty data word is often similarly

unpredictable, but can sometimes be tolerated (for instance, it might merely appear as a corrupted pixel on a video display).

The *HP Vectra XU 6/xxx PC* and *HP Vectra VT 6/xxx PC* are supplied with 16 MB of main memory as standard. The banks can be filled in any order, up to a maximum capacity of 256 MB, but always in pairs of memory modules of the same capacity and same type (ECC or non-ECC). Only the *HP Vectra XU 6/xxx PC* supports ECC (error correcting code) memory, but even this will be disabled if any non-ECC memory is installed. Conversely, the *HP Vectra VT 6/xxx PC* will accept 16 MB and 32 MB ECC modules, but will treat them as non-ECC memory.

The *Setup* program automatically detects which memory module capacity, speed, and type (ECC or non-ECC) is installed in each bank.

Extending the capacity of main memory, and upgrading it with faster chips, can never have a detrimental effect on the performance. However, it *can* experience a law of diminishing returns, so that upgrading the memory does not have a cost-effective impact on the performance. Finding the correct combination is an empirical process, whether it be through simulation, or by trial and error on the real hardware.

DEVICES ON THE PCI BUS

The PL/PCI bridge chip (OPB) is an Intel S82454KX. It is responsible for transferring data between the Processor-Local bus and the PCI bus. It also houses the controller for the PCI bus.

- Fast-20 SCSI-2 interface (*HP Vectra XU 6/xxx PC* only)
- IDE controller
- other devices in the PCI accessory slots, including:
    - video controller
    - LAN controller.

SMALL COMPUTER SYSTEM INTERFACE (SCSI)

An Adaptec AIC-7880 controller is integrated on the *HP Vectra XU 6/xxx PC* system board. It implements Fast-20 SCSI-2 (also known as Ultra-SCSI). It attains data transfer rates up to 20 MB per second on 8-bit wide data, single-ended. It supports up to seven SCSI devices, with a choice of internal and external SCSI connectors. The external SCSI connector is on the rear panel.

An HP provided driver is required for the OS/2 2.11 and Windows NT operating systems; an HP provided driver is also recommended for the Windows 3.11, Windows 95 and OS/2 Warp Connect operating systems.

SCSI-configured-automatically (SCAM) support is provided at level 1, for Plug and Play.

INTEGRATED DRIVE ELECTRONICS (IDE)

The CMD646 chip supports Enhanced IDE (EIDE) and Standard IDE. To use the Enhanced IDE features, though, hard disk drives must be compliant with Enhanced IDE.

Up to four IDE devices can be supported: two connected to the primary channel cable, and two to the secondary channel cable. With EIDE, it is possible to have a fast device, such as a hard disk drive, and a slow device, such as a CD-ROM, on the same channel without affecting the performance of the fast device. The BIOS automatically sends a command to auto-detect each drive, and thereby select, automatically, the fastest configuration that is supported by it. However, in general, the primary channel cable (the grey one) is recommended for hard disk drives, and the secondary channel cable (the red one) for CD-ROM drives.

Transfer Rates Versus Modes of Operation

The controller supports 32-bit Windows and DOS I/O transfers (many IDE controllers use Windows integral IDE driver which only supports 16-bit I/O transfers). It has PCI master capability, and supports programmed I/O (PIO) modes up to mode 4 and direct memory access (DMA) modes up to mode 2 (giving a cycle time of 120 ns, and a transfer rate of 16.7 MB per second, in both cases). The five PIO modes allow the following transfer rates:

Mode	0	1	2	3	4
Cycle time (ns)	600	383	240	180	120
Transfer rate (MBytes/s)	3.33	5.22	8.33	11.1	16.7

The three DMA modes allow the following transfer rates:

Mode	0	1	2
Cycle time (ns)	480	150	120
Transfer rate (MBytes/s)	4.2	13.3	16.7

Operated in SLAVE mode, the IDE controller saturates the PCI bus with transfers, thus limiting the actual achieved transfer rate to 4 or 5 MBytes per second. Operated in MASTER mode, though, the IDE controller is allowed to work autonomously of the CPU, and the full 16.7 MBytes per second transfer rate can be achieved, with less than 33% occupancy of the PCI bus (so allowing the CPU to get on with other work for more than 67% of the cycle times, whilst the IDE transfers are going on in parallel).

Disk Capacity Versus Modes of Addressing

The amount of addressable space on a hard disk drive is limited by three factors: the physical size of the hard disk, the addressing limit of the IDE hardware, and the addressing limit of the BIOS. The Extended-CHS addressing scheme allows larger disk capacities to be addressed than under CHS, by performing a translation (for example regrouping the sectors so that there are twice as many logical tracks as is possible under the CHS addressing scheme). If the *Setup* field has been set to **automatic**, the logical block addressing (LBA) mode will be selected for each device that supports it.

	Cylinders per Device	Heads per Cylinder	Sectors per Track	Bytes per Sector	Bytes per Device
CHS	64	16	1024	512	528 M
ECHS	64	256	1024	512	8.4 G
LBA	-	-	256 M (=228)	512	137 G

OTHER PCI ACCESSORY DEVICES

PCI accessory boards are for high-speed peripheral accessories. There are four slots on the PCI bus for accessory boards. One of these is already occupied by the video controller board, and a second (on the *HP Vectra XU 6/ xxx PC*) by the LAN board; these are described in the next chapter. The fourth slot is a combination slot with the ISA bus.

Plug and Play

Plug and Play is an industry standard for automatically configuring the PC's hardware. When you start the PC, the Plug and Play system BIOS can detect automatically which hardware resources (IRQs, DMAs, memory ranges, and I/O addresses) are used by the system-based components.

The *HP Vectra XU/VT 6/xxx PC*s have a "PnP level 1.0A" BIOS and meets the "Windows 95 Required" level for Plug and Play. Accessory boards which are Plug and Play are automatically configured by the BIOS (Windows 3.11) or by the operating system (Windows 95).

Error Diagnostics and Suggested Corrective Actions

Most problems caused by incompatibilities on PCI accessory boards are detected by the POST during the Power-On sequence. This is described in Chapter 5.

DEVICES ON THE ISA BUS

The PCI/ISA bridge chip (otherwise known as the system I/O chip, SIO-A) is an Intel S82379AB. It is responsible for transferring data between the PCI bus and the ISA expansion bus. It also houses the controller for the ISA bus, and incorporates the logic for a DMA interface, a DMA controller that supports fast DMA transfers, data buffers to isolate the PCI and ISA buses, Timer/Counter logic, APIC, and NMI control logic.

- Ultra I/O controller, containing the following:
  - serial / parallel communications ports
  - flexible drive controller (FDC)
  - real time clock (RTC) and CMOS memory
  - keyboard and mouse controller
- serial EEPROM
- Little BEN
- audio controller
- System ROM
- other ISA accessory devices.

ULTRA I/O CONTROLLER

Serial / parallel communications ports

The Ultra I/O chip (SMC 37C932) supports two serial ports and one bidirectional multi-mode parallel port. The two 9-pin serial ports (on the rear panel) support RS-232-C and are buffered by 16550 UARTs, with 16 Byte FIFOs. They can be programmed as COM1, COM2, COM3, COM4, or disabled.

The 25-pin parallel port (also on the rear panel) is Centronics compatible, supporting IEEE 1284. It can be programmed as LPT1, LPT2, or disabled. It can operate in the following modes:

- Standard mode (PC/XT, PC/AT, and PS/2 compatible).
- Bidirectional mode (PC/XT, PC/AT, and PS/2 compatible).
- Enhanced mode (enhanced parallel port, EPP, compatible).
- High speed mode (MS/HP extended capabilities port, ECP, compatible).

FDC

The flexible drive controller (FDC) is software and register compatible with the 82077AA, and 100% IBM compatible. It has an A and B drive-swapping capability and a non-burst DMA option. It

supports the D2035B, 3.5-inch, 1.44 MB flexible disk drive.It is software compatible with the DP8473, the 765A, and the N82077. It has a 16-byte FIFO, though this is disabled by default. It supports burst and non-burst modes. It provides perpendicular recording drive support. It has a high-performance internal digital data separator (no external filter components are required). It is implemented in low-power CMOS technology.

RTC

The real-time clock (RTC) is 146818A-compatible. The configuration RAM is implemented as 256 bytes of CMOS memory.

Serial EEPROM

This is where the default values for the *Setup* program are held.

Keyboard and Mouse Controller

The *HP Vectra XU 6/xxx PC* and *HP Vectra VT 6/xxx PC* have an 8042-based keyboard and mouse controller.

LITTLE BEN

Little BEN is an HP application specific integrated circuit (ASIC) that contains the following:

- hard and soft control for the power supply
- BIOS timer
- flash access and protection
- Ultra I/O protection
- programmable chip selects
- glue logic

AUDIO CONTROLLER

The *HP Vectra XU 6/xxx PC* and *HP Vectra VT 6/xxx PC* have a Creative Labs Vibra 16S CT2504 SoundBlaster 16 audio interface integrated on the system board. This has the following specification:

- 80 dB SNR
- 8-bit and 16-bit stereo sampling from 5 kHz to 44.1 kHz
- Yamaha FM OPL3 synthesizer (11 polyphonic voices)
- connector for WaveBlaster standard (wave-table synthesizer) board
- 3 inputs (1 microphone, 1 stereo-in, 1 CD-ROM)
- 3 outputs (1 internal speaker, 2 stereo-out capable of supporting low-impedance headphones)
- connector for MIDI /joystick interface (MPU-401 UART compatible).

The headphones jack, microphone jack, and volume control are each on the front panel; the MIDI socket, stereo-in (audio) jack and stereo-out (audio) jack are each on the rear panel. The microphone input has an input impedance of 600 ohms and a sensitivity of 30 mV (peak-to-peak) to 200 mV (peak-to-peak). The headphones jack and the stereo-out (audio) jack each supply 2 W per channel into a 4 ohm load, and can thus be used interchangeably.

The Windows 95, OS/2 and Windows NT operating systems each have integrated drivers (*Creative SoundBlaster 16*). The DOS and Windows 3.x operating systems require the installation of HP *Menuet* drivers.

SYSTEM ROM

The System ROM consists of 256 KB of 200ns, Flash EEPROM, implemented within a single 256 K 5 8-bit ROM chip. This is a ROM that is returned to its unprogrammed state by the application of appropriate electrical signals to its pins, and hence can then be reprogrammed with the latest upgrade firmware.

The System ROM contains the LAN boot firmware, and the system BIOS (including the boot code, the ISA and PCI initialization, the *Setup* program and the Power-On Self-Test routines, plus their error messages). These are summarized in Chapters 4 and 5.

Updating the System ROM

The System ROM can be updated with the latest BIOS firmware. This can be ordered from HP or downloaded from one of HP's online services. (For more information on HP's online services, refer to the Hewlett-Packard Support and Information Services chapter in the User's Guide that was supplied with the computer.)

The System ROM is updated by running the HP6Init utility (**HP6INIT.EXE**) which is supplied with BIOS upgrade. The procedure for doing this is given in the *User's Guide* that is supplied with the computer.

You must specify the *model number* of the PC since the utility which supplied for a different model cannot be used with this one. It must be run from diskette. Do not switch off the computer until the system BIOS update procedure has completed, successfully or not, since irrecoverable damage to the ROM may be caused. While updating the flash ROM, the power supply switch and the reset button are disabled to prevent accidental interruption of the flash programming process.

Error Diagnostics and Suggested Corrective Actions

The programs and data in the system ROM are accompanied by a check-sum code. If any of the programs or data ever become corrupted, the check-sum will no-longer correspond with the contents of the ROM, and the appropriate part of the POST routine will attempt to report the error:

```
Cannot display error messages
Flash ROM may be defective
```

The suggested corrective action is to reprogram the system ROM by running the same *HP6Init* utility as is normally used for upgrading it.

OTHER ISA ACCESSORY DEVICES

ISA accessory boards are for slow peripheral accessories. There are three slots on the ISA bus for accessory boards. One of these is a combination slot with the PCI bus.

Plug and Play

All PCI accessory boards are Plug and Play, although not all ISA boards are. Check the accessory board's documentation if you are unsure.

The procedure for installing an ISA accessory board that is not Plug and Play in Windows 3.11 or Windows 95 is described in the *User Guide* that is supplied with the PC.

Error Diagnostics and Suggested Corrective Actions

Most problems caused by incompatibilities on ISA accessory boards are detected by the POST during the Power-On sequence. This is described in Chapter 5.

3 INTERFACE BOARDS AND MASS-STORAGE DRIVES

This chapter describes the video, disk and network devices which are supplied with the PC. These include the Matrox MGA Millennium video

controller board, and the HP PCI Integrated 10/100 VG Interface. It also includes the hard disk drives, flexible disk drives and CD-ROM drives that are supplied with the PC.

Matrox MGA Millennium Video Controller Board

All models are supplied with a Matrox MGA Millennium PCI video controller on a board fitted in a PCI accessory slot. This controller has an MGA-2064W processor, 2 MB video memory installed on the board, a VESA feature connector, and a socket for either a video memory upgrade module or an MPEG upgrade module. The possible upgrades for this socket are the following:

Add on module	HP Part Number	Matrox Part Number
2 MB video memory module	D3557A	MGA-MIL/MOD2
6 MB video memory module	not available	MGA-MIL/MOD6
MPEG module	not available	MGA-MIL/Media-XL

The video RAM (also known as window RAM, or WRAM) is a local block of RAM for holding two major data structures: the double buffer (to hold one frame steady on the screen whilst the next one is being processed), and the Z-buffer (for storing depth information for each pixel). It is dual ported, so that it can be inputting and outputting simultaneously.

The controller uses the PCI bus for data transfers between the processor and the video subsystem, and has the following features:

- 100% compatible with IBM® VGA display standard
- 64-bit video memory access
- Hardware acceleration of graphical user interface (GUI) operations
- Support for up to 8 MB Video RAM (Window RAM) at 60 ns
- Graphics resolutions of up to 1600 5 1200
- Integrated 24-bit, 175 MHz RAMDAC
- Pixel clock maximum frequency of 135 MHz
- Green PC power saving features
- Standard and Enhanced Video Graphics Array (VGA) modes
- DDC 2B compliant.

Drivers are not integrated into any of the operating systems, so HP-provided drivers must be installed.

AVAILABLE VIDEO RESOLUTIONS

If you attempt to set the resolution or number of colors higher than is supported by the installed video memory, the screen refresh rate is lowered automatically, and image flicker becomes more noticeable. If the resolution/ refresh-rate combination is set higher than the display can support, you risk damaging the display.

The number of colors supported is limited by the graphics card and the video RAM. The resolution/refresh-rate combination is limited by a combination of the display, the graphics card, and the video RAM.

Resolution	**Number of colors**	**Video Adapter Maximum Refresh Rate (Hz)**	**Memory**
640 x 480	256, 64K, 16M	120	2 MB
800 x 600	256, 64K, 16M		
1024 x 768	256, 64K		
1280 x 1024	256	100	
1600 x 1200*	256	72	
640 x 480	256, 64K, 16M	120	4 MB
800 x 600	256, 64K, 16M		
1024 x 768	256, 64K, 16M		
1280 x 1024	256, 64K, 16M (24 bpp)	100	
1600 x 1200*	256, 64K	72	
640 x 480	256, 64K, 16M	120	8 MB
800 x 600	256, 64K, 16M		
1024 x 768	256, 64K, 16M		
1280 x 1024	256, 64K, 16M	100	
1600 x 1200*	256, 64K, 16M	72	

*The upper limit of refresh rate for HP monitors is 60Hz at this resolution.

The table below summarizes the video resolutions which are supported. However, SCO Unix only supports 15 BPP, instead of 16 BPP, and does not support 32 BPP; OS/2 does not support 24 BPP.

Number of Colors	256	64 K Hi-Color	16.7 M True-Color	16.7 M True-Color
Bits per Pixel	8	16	24	32
640 x 480	2 MB, 120 Hz			
800 x 600	2 MB, 120 Hz			
1024 x 768	2 MB, 120 Hz		4 MB, 120Hz	
11x2 x 882	2 MB, 100 Hz		4 MB, 100 Hz	
1280 x 1024	2 MB, 100 Hz	4 MB, 100 Hz		8 MB, 100 Hz
1600 x 1200*	2 MB, 72 Hz	4 MB, 72 Hz	8 MB, 72 Hz	Not supported

*The upper limit of refresh rate for HP monitors is 60Hz at this resolution.

The maximum 2D resolutions for any given video memory capacity and color scale can be found from the following table:

Number of Colors	256	64 K Hi-Color	16.7 M True-Color	16.7 M True-Color
Bits per Pixel	8	16	24	32
2 MB	1600 x 1200	1024 x 768[1]	800 x 600	800 x 600
4 MB	1600 x 1200	1600 x 1200	1280 x 1024	11x2 x 882
8 MB	1600 x 1200	1600 x 1200	1600 x 1200	Not supported

VESA CONNECTOR

The Video Electronics Standards Association (VESA) defines a standard video connector, variously known as the VESA *feature* connector, *auxiliary* connector, or *pass-through* connector. The Matrox MGA Millennium video adapter board supports an output-only VESA *feature* connector in VGA mode. This connector is integrated on the adapter board, and is connected directly to the pixel data bus and the synchronization signals.

VIDEO BIOS

Tables that detail the standard VGA modes which are currently implemented in the video BIOS can be found in the *Matrox MGA Millennium Adapter* documentation, on the *XU/VT Drivers and Documentation* CD-ROM that is supplied with the computer.

The capability to flash program the video BIOS is a feature of the Matrox MGA Millennium board. This is achieved as follows:

1 Set SW-1, on the Matrox board, to ON (BIOS unprotected).

2 Set the “Operating System” field in the *Setup* program to Others.

3 Run the video BIOS flash program, **progbios.exe**, and the associated ***.bin** file, which are provided by HP.

4 Set SW-1, on the Matrox board, to OFF (BIOS protected).

5 Set the “Operating System” field in the *Setup* program back to an appropriate setting.

Video boards without ROM (such as old CGA and monochrome) are not supported by the BIOS. Memory holes above 1 MB are not supported. DDC display detection is not a BIOS feature, but is handled by the video drivers.

ERROR DIAGNOSTICS AND SUGGESTED CORRECTIVE ACTIONS

Further help can be found in the *Matrox MGA Millennium Adapter* documentation, on the *XU/VT Drivers and Documentation* CD-ROM that is supplied with the computer.

For more information on the Matrox MGA Millennium video adapter board, contact Matrox Electronic Systems.

Matrox Electronic Systems Ltd.1055 St. Regis Blvd.
Dorval, Quebec
Canada H9P 2T4
Telephone: (514) 685-2630
Fax: (514) 685-2853
BBS: (514) 685-6008

HP PCI INTEGRATED 10/100 VG INTERFACE

The HP PCI Integrated 10/100 VG Interface is supplied in a PCI accessory slot of the *HP Vectra XU 6/xxx PC*. Both the A model and B model of this interface support the following two standards: 100 VG-AnyLAN, 100 Mbits per second over voice grade cable (IEEE 802.12 standard for Ethernet); 10 BaseT, 10 Mbits per second, ISO 8802-3 (IEEE 802.3 standard).

On the rear panel there are either one or two RJ-45 unshielded-twisted-pair (UTP) connectors. One is for 100 Mbits per second and the other for 10 Mbits per second, or else they are both combined in a single connector. The D2746A Coaxial Adapter accessory is available for users who require a BNC coax connector. There are four lights for monitoring the adapter status, as summarized in the following list:

- Activity light, showing network activity
- Link status light
- 100 Mbit/s light
- 10 Mbit/s light.

The following tables summarize the meanings of the various combinations of these lights being illuminated:

10-Mbits/s Operation

Link Status Light	10-Mbits/s Light	100-Mbits/s Light	Explanation
ON	ON	OFF	Normal operation
OFF	OFF	ON	Either: Cable is not connected to an active 10BaseT network. Cable is defective. LAN Adapter is defective.

100-Mbits/s Operation

Link Status Light	10-Mbits/s Light	100-Mbits/s Light	Explanation
ON	OFF	ON	Normal operation
OFF	OFF	ON	Either: Cable is not connected to an active 100VG network. Cable is defective. LAN Adapter is defective.

For the temporary storage of data received or awaiting transmission over the network, the A model has a 128 KB *packet buffer*. The B model has a 32 KB packet buffer.

The new, enhanced *demand priority access* (DPA) protocol guarantees access to any end node that requests to transmit, while ensuring priority access to end nodes that require consistent, and thereby, continuous access for applications such as full-motion video or video conferencing. This protocol, through being collisionless with priority allocation, allows you to minimize unused capacity on your network, and so maximizes network throughput.

The A model can be configured completely by software (no switches or jumpers need changing). The controller can be I/O mapped or memory mapped: the fastest mode is automatically selected by the driver. An HP provided driver needs to be installed within the operating system.

The B model is I/O mapped, and has Bus-Master capability.

The *HP Vectra XU 6/xxx PC* is supplied with a multi-protocol boot program integrated within the System ROM, and has a complete LAN client drivers and diagnostics package (Microsoft client, Novell client, IBM LAN server client and Warp connect, Banyans client, DEC pathworks client, all major TCPIP stacks, Lantastic).

ERROR DIAGNOSTICS AND SUGGESTED CORRECTIVE ACTIONS

Diagnostic software, in the form of a DOS utility called *HPVGSet*, is provided on the *XU/VT Drivers and Documentation* CD-ROM.

The LAN administrator's guide (provided in ASCII, WINHELP and HTML format) is a useful source of further information. The *HP 10/100 VG Selectable PC LAN Adapters Installation Guide* (5963-2665) contains detailed diagnostic information.

MASS-STORAGE DRIVES

The SCSI and IDE controllers are described in chapter 2. The flexible disk controller is described in chapter 2.

HARD DISK DRIVES

A 3.5-inch hard disk drive is supplied on an internal shelf in some models of the *HP Vectra XU 6/xxx PC* and the *HP Vectra VT 6/xxx PC*.

	HP Vectra XU 6/xxx PC		**HP Vectra VT 6/xxx PC**	
	2 GB SCSI	**1 GB SCSI**	**2 GB IDE**	**1 GB IDE**
HP product number	D2926A	D2920A	D2928A	D2919A
Manufacturer	Seagate	Quantum	Seagate	Quantum
Product name	Barracuda 2LP ST32550N	Fireball 1080S	Cyclone ST32140A	Fireball 1080AT
Average seek time	10 ms	12 ms	10 ms	12 ms
Revolutions per minute (RPM)	7200	5400	4500	5400
Average latency	4.2 ms	5.6 ms	5.6 ms	5.6 ms
Maximum transfer rate	10 MB/s	10 MB/s	16.7 MB/s	16.7 MB/s
Read/write cache memory size	480 KB	80 KB		80 KB
Buffer size	512 KB	128 KB	256 KB	128 KB

FLEXIBLE DISK DRIVES

A 3.5-inch, 1.44 MB flexible disk drive (D2035B) is supplied on the top front-access shelf of all models of the *HP Vectra XU 6/xxx PC* and the *HP Vectra VT 6/xxx PC*.

CD-ROM DRIVES

A D2992B quadruple-speed (45) SCSI CD-ROM drive is supplied on the bottom front-access shelf of the *HP Vectra XU 6/xxx PC*.

A D2896B quadruple-speed (45) IDE CD-ROM drive is supplied on the bottom front-access shelf of the *HP Vectra VT 6/xxx PC*.

4 HP BIOS

The *Setup* program and BIOS are covered in the two sections of thischapter. The first section lists the fields which are presented by the *Setup* program, describing the purpose of each, and the options which are available. The second section lists the reserved addresses that are used by the BIOS.

The POST routines are described in the next chapter.

SETUP PROGRAM

You can interrupt the POST to run the *Setup* program by pressing [F2] when the F2=*Setup* message appears on the initial “Vectra” screen.

The up and down arrows allow the cursor to be moved from one field to the next (also the left and right arrows, when there is more than one field on the line). Pressing [F1] causes a “Help” screen to appear, containing a more detailed description of what the field is for, and what the options are; pressing [F1] again causes the “Help” screen to disappear again. Pressing [F8] causes the contents of the field to be changed to the next available option, and pressing [F7] causes the contents to be changed back to an earlier option. Pressing [F10] causes the page to be sent to the printer port. Pressing [F3] causes a save and exit from the *Setup* program, and pressing [F12] causes an exit without updating the configuration.

A complete list of fields, their meanings, and the options which are available, can be found on the following pages. They include the following new features:

- A “Configuration Summary” screen.

- Within the “user preferences” section:
  - An “operating system” field (for setting **Windows 95, Windows NT, IBM OS/2** or **Others**)
  - A “space-bar power on” field
  - A “memory test” field (which can be set to **disabled** for fast boot).

- Two “IDE” sections, one for the primary channel, and one for the secondary channel. Within each section, fields are provided to set (1) the use of two drives, (2) whether the transfer speed is optimized or standard, and (3) whether the translation method is automatic, standard CHS or extended CHS.

- A “start-up center” section, containing fields that allow the selection of boot device (FDD, HDD, LAN). Booting from a SCSI device is possible in mixed IDE/SCSI configurations on the *HP Vectra XU 6/xxx PC*.

- An “audio” section, with fields that allow for the setting of addresses, IRQs, DMA channels.

You can scroll down through the fields using the down arrow key or the [PAGE DOWN] button. Similarly, the up arrow key or the [PAGE UP] button can be used for going back to earlier fields in the program.

The *Setup* program is sufficiently intelligent as to not allow the user to set illegal settings within the fields. For instance, if Serial Port A is set to using IRQ4, then IRQ4 will not be offered as an option for use when setting Serial Port B.

Field name	Purpose	Options	Remarks
Date	Sets the date	YYYY/MM/DD	
Time	Sets the time	HH:MM:SS	
CONFIGURATION SCREEN			
System BIOS Version	Displays version number	Cannot be change	All of these are automatically detected, and cannot be changed Automatically detected if the original system board is present; else, if it has been changed, the serial number will be blank. It is possible to use MS-DOS, *Setup* and HP Vectra diagnostics without ti being set. POST will detect no serial number as an error. Follow the instructions as they appear on the screen to enter the new number; when completed this will then appear on future *Setup* screens
MILLENNIUM Video Board	Displays type, memory size, video BIOS and version number	Cannot be changed	e.g. MILLENNIUM, 2.0MB, Version: 838-7
Processor	Displays processor & speed	Cannot be changed	e.g. (Processor: Pentium Pro, 150MHz)
Memory	Displays capacities	Cannot be changed	e.g. (16MB: 640KB Base, 384KB Reserved, 15360KB Extended)
IDE Hard Disk Drives	Indicates if one is detected	Cannot be changed	e.g. (No IDE disk detected)
LAN Interface	Indicates MAC address if detected		e.g. (MAC Address 08 00 09 A8 E5 82)
USER PREFERENCES			
Operating System	Selects which operating system is to be run	Microsoft WINDOWS 95/ IBM OS2 / Microsoft WINDOWS NT/ Others	To set your password press [ENTER] type your password and press [ENTER] type your password and press [ENTER] again and the screen will show that the password is set.
User Password	Prevents unauthorized access to your PC	Set / Not set	
Key Autorepeat Speed	Sets the speed at which a key's function repeats	2 to 30 per second	
Delay Before Autorepeat	Sets the delay before which a key automatically repeats its function	0.25 to 1 second	
Power-on NumLock State	Sets whether the NumLock key is enabled when the PC is powered on	On / Off	
Space-bar Power On	Allows the PC to be re-activated by pressing the space-bar	Enabled / Disabled	
Memory test	Allows time to be saved during a reset, by not testing the main memory	Enabled / Disabled	

MEMORY SIZE			
Base, on system board Base, on accessory board Base, TOTAL Reserved Extended TOTAL	Confirms that *Setup* has detected and configured the memory size fields	512 KB / 640 KB	Ensure that the TOTAL field is correct.
Memory hole below 1 MB	Tells *Setup* the size and location of any ISA accessory boards which are memory mapped below 1 MB	Board's base address (from C800h to DC00h) and memory size (16,32,48 or 64 KB)/ Disabled	To be used if the installed ISA board has memory mapped below 1 MB (refer to the accessory boards manual).
IDE PRIMARY CHANNEL			
Device 1	Defines the first primary IDE hard disk drive	None or SCSI / Custom	Configuration is automatic for HP IDE hard disk drives. Only use the Custom option for non-HP IDE hard disk drives.
Device 2	Defines the second primary IDE hard disk drive	None or SCSI / Custom	Configuration is automatic for HP IDE hard disk drives. Only use the Custom option for non-HP IDE hard disk drives.
Data Transfer Speed	Sets between EIDE and the original (older) IDE protocol	Optimized / Standard	Select Optimized for maximum performance, or Standard if IDE devices do not work properly.
Translation Method	Sets between CHS, ECHS, or LBA	Automatic / Standard CHS / Extended CHS	For hard disk drives with more than 1023 cylinders: select Automatic for MS-DOS, Extended CHS for Netware, Standard CHS for Unix.
Primary Integrated Channel	Defines whether or not the integrated IDE controller is used	Enabled / Disabled	Configure any controller board according to its manual.
IDE SECONDARY CHANNEL			
Device 3	Defines the first secondary IDE hard disk drive	None or SCSI / Custom	Configuration is automatic for HP IDE hard disk drives. Only use the Custom option for non-HP IDE hard disk drives.
Device 4	Defines the second secondary IDE hard disk drive	None or SCSI / Custom	Configuration is automatic for HP IDE hard disk drives. Only use the Custom option for non-HP IDE hard disk drives.
Data Transfer Speed	Sets between EIDE and the original (older) IDE protocol	Optimized / Standard	Select Optimized for maximum performance, or Standard if IDE devices do not work properly.
Translation Method	Sets between CHS, ECHS, or LBA	Automatic / Standard CHS / Extended CHS	For hard disk drives with more than 1023 cylinders: select Automatic for MS-DOS, Extended CHS for Netware, Standard CHS for Unix.
Secondary Integrated Channel	Defines whether or not the integrated IDE controller is used	Enabled / Disabled	Configure any controller board according to its manual.

INTEGRATED SCSI INTERFACE			
Integrated Interface	Defines whether or not the integrated SCSI interface is used	Enabled / Disabled	
SCSI BIOS	To shadow the SCSI BIOS in faster RAM for HP SCSI adapters	Enabled / None	Configure any controller board according to its manual.
Ultra SCSI	Selects the level of automation of SCSI support	Automatic / Enabled/ Disabled	
FLEXIBLE DISK DRIVES			
Drive 1	Defines the top flexible disk drive	None / 5.25-inch 360 KB / 5.25-inch 1.2 MB / 3.5-inch 1.44 MB / 3.5-inch 2.88 MB	Detected by *Setup*
Drive 2	Defines the second flexible disk drive	None / 5.25-inch 360 KB / 5.25-inch 1.2 MB / 3.5-inch 1.44 MB / 3.5-inch 2.88 MB	Detected by *Setup*
Bootable drive	Defines the flexible disk drive from which to start (boot) the system	Drive 1 / Drive 2	
Interface	To define if the flexible disk drive controller is integrated	Integrated / Controller Board	Configure any controller board according to its manual
SECURITY FEATURES			
System Administrator Password	Prevents unauthorized access to the configuration settings in *Setup*	Set / Not set	Similar procedure as for the setting of the User Password
Start With Keyboard Locked	To lock the keyboard on power-on	Enabled / Disabled	Enable when the PC is used as a Network Server
Flexible Disk Drives	To disable flexible disk access	Enabled / Disabled	
Writing on Flexible Disks	To disable writes to the flexible disk	Allowed / Not Allowed	
PnP Board Activation	Select the level of support for Plug and Play accessories)	None / Boot only / Full	
START-UP CENTER			
Start From Flexible Disk	To allow booting from a flexible disk	Enabled / Disabled	
Start From CD-ROM	To allow booting from a CD-ROM	Enabled / Disabled	
Start From Hard Disk	To allow booting from a hard disk	Enabled / Disabled	
Start with Network	To allow booting from the network	Enabled / Disabled	
Protocol	Select which protocol will be used for Remote Start	NOVELL/ETHERNET/802.12/RIPL or MICROSOFT/ETHERNET/802.12/RIPL orNot Used	

INTEGRATED COMMS			
Parallel Port	Sets the parallel port as LPT1 or LPT2 or disabled	Parallel 1 (378h, IRQ7) / Parallel 2 (278h, IRQ5) / Disabled	
Parallel Port Mode	Sets the parallel port into Centronics, ECP or EPP mode	Centronics(R) / Bi-directional EPP / Bi-directional ECP (DMA1 / DMA3)	If the peripheral has an ECP/EPP interface, use a compatible cable.
Serial Port A	Sets serial port A to COM1, COM2, COM3, COM4 or disabled	Serial 1 (3F8h, IRQ4) / Serial 2 (2F8h, IRQ3) / Serial 3 (3E8h, IRQ4) / Serial 4 (2E8h, IRQ3) / Disabled	
Serial Port B	Sets serial port B to COM1, COM2, COM3, COM4 or disabled	Serial 1 (3F8h, IRQ4) / Serial 2 (2F8h, IRQ3) / Serial 3 (3E8h, IRQ4) / Serial 4 (2E8h, IRQ3) / Disabled	Serial port A and serial port B cannot be set to the same address, or the same IRQ.
AUDIO			
Audio Functions	Specifies whether the audio system is used	Enabled / Disabled	If disabled, the audio fields default to “Not Available”.
Base I/O Address	Select which protocol will be used for Remote Start	220h / 240h / 260h / 280h	
IRQ line	Selects between the IRQ lines that can be allocated to the audio system	5 / 7 / 10	
8-bit DMA Channel	Selects between the DMA channels that can be allocated to the audio system for 8 bit transfers	1 / 3	
16-bit DMA Channel	Selects between the DMA channels that can be allocated to the audio system for 16-bit transfers	5 / 7	
MIDI Port Base I/O Address	Selects between the base address that can be allocated to the audio system	300h / 330h	
Joystick/Game Port	Defines whether used or not	Enabled/Disabled	
IRQ MAP FOR ACCESSORY BOARDS			
IRQ 9	View available IRQ channels and select which IRQs are used by installed accessory boards	Used by ISA board / Available for PCI or PnP	Always leave at least two IRQs set as being “Available for PCI”.
IRQ 10	If you have installed an ISA board, this is used to tell *Setup* which IRQ the board uses, and allows PCI boards to be configured automatically	Used by ISA board / Available for PCI or PnP	
IRQ 11		Used by ISA board / Available for PCI or PnP	
IRQ 15		Used by IDE Secondary Channel	
IRQ 12		Mouse / Accessory Board	IRQ12 is normally used by the mouse.
PC Serial Number	Displays the PC serial number	Cannot be changed	Automatically detected.

BIOS

This section provides a summary of the main features of the HP system BIOS. This is software that provides an interface between the computer hardware and the operating system.

The procedure for updating the System ROM firmware is described under "System ROM" in chapter 2.

There is BIOS support for ISA “Plug and Play” accessory board configuration. It includes support for Plug and Play 1.0A, IDE PIO mode 4, Startup center, flash memory, desktop management interface (DMI) and the data integrity features. It ensures PCI 2.0 compliance with PCI-to-PCI bridge support. The Fast-20 SCSI-2 BIOS is also integrated with the system BIOS.

I/O ADDRESSES USED BY THE SYSTEM*

Peripheral devices, accessory devices and system controllers are accessed via the system I/O space, which is not located in system memory space. The 64 KB of addressable I/O space comprises 8-bit and 16-bit registers (called I/O ports) located in the various system components. When installing an accessory board, ensure that the I/O address space selected is in the free area of the space reserved for accessory boards (100h to 3FFh).

*If configured.

170h-177h	Hard IDE disk controller 2 (ISA)
1F0h-1F7h	Hard IDE disk controller 1 (PCI)
200h	Joystick port
220h-232h	Audio chip 1 (SoundBlaster)
240h-252h	Audio chip 2(SoundBlaster)
260h-272h	Audio chip 3 (SoundBlaster)
278h-27Fh	Parallel port 2
280h-292h	Audio chip 4 (SoundBlaster)
2E8h-2EFh	Serial port 4
2F8h-2FFh	Serial port 2
300h-30Bh	MPU-401 1
330h-33Bh	MPU-401 2
370h-371h	reserved (for the integrated Ultra I/O controller, SMC 932, I/O configuration)
376h-377h	Hard IDE disk controller 2 (ISA)
378h-37Ah	Parallel port 1
388h-38Bh	Ad-lib / FM
3B0h-3DFh	Video adapter
3E8h-3EFh	Serial port 3
3F0h-3F7h	Primary flexible disk drive controller
3F8h-3FFh	Serial Port 1

Refer to the “HP BIOS I/O Port Map” later in this chapter for more detailed information.

SYSTEM MEMORY MAP

00000h - 9FFFFh	640 KB--DOS Application Area
A0000h - BFFFFh	128 KB--Video Buffer
C0000h - C7FFFh	32 KB--Video BIOS
C8000h - EFFFFh	160 KB--ISA Expansion Memory
C8000h - D3FFFh	SCSI BIOS
E0000h - EFFFFh	Boot ROM
F0000h - FFFFFh	64 KB--System BIOS
100000h - FFFFFFFFh	1 MB plus--Extended Memory

NOTE	Reserved memory used by accessory boards must be located in the area from C8000h to EFFFFh.

PRODUCT IDENTIFICATION

The following product identification strings are located in the 64 KB BIOS ROM data area.

Location	Size	Contents	Description
0F000:00F2h	byte	4Dh	System number for *HP Vectra XU 6/xxx PC*
		5Bh	System number for *HP Vectra VT 6/xxx PC*
0F000:00F3h	byte	14h	Extended identification byte (14h = Pentium Pro)
0F000:00F4h	byte	*speed* (in MHz)	High processor clock frequency
0F000:00F5h	byte	08h	Low processor clock frequency
0F000:00F8h	word	4646h	HP Vectra PC ID (ASCII “FF”)
0F000:00FAh	byte	FFh	Product Identification
0F000:00FCh	word	*pp*ssh	BIOS version number
			pp = primary number
			ss = secondary number
0F000:00FEh	byte	*yy*h	ROM release year (since 1960)
0F000:00FFh	byte	*nn*h	Week of the year stored in BCD
0F000:0102h	word	4850h	Computer ID (ASCII “HP”)

BIOS VERSION NUMBER

0F000:00FCh = BIOS version number

Length = two bytes

Encoding is as follows:

*pp*ss

where *pp* = Primary version number and *ss* = Secondary version number

For *HP Vectra XU 6/xxx PC*, all BIOS releases have GG as the prefix and 06 as the primary version number. For *HP Vectra VT 6/xxx PC*, all BIOS releases have GV as the prefix and 06 as the primary version number.

For example; BIOS release GG.06.01 would be expressed as:

0601

Note that if you use DEBUG to look at the bytes, the numbers will be reversed (0106).

In fact, the BIOS binary code is the same for both PCs. The same program is downloaded in either case. However, when it is run on an *HP Vectra VT 6/ xxx PC*, it is copied into shadow RAM, as usual, but the “GG” prefix is then overwritten by “GV”.

YEAR OF THE ROM BIOS RELEASE

0F000:00FEh = Year of ROM BIOS release in Binary Coded Decimal (BCD)

Length = one byte

Encoding is as follows:

yy

where *yy* is the difference between the current year and 1960 in BCD.

For example; if the current year is 1995, the year code would be 1995 minus 1960, which is 35h expressed in BCD.

WEEK OF THE ROM BIOS RELEASE

0F000:00FFh = Week of the ROM BIOS release in Binary Coded Decimal (BCD)

Length = one byte

Encoding is as follows:

nn

where *nn* is the week in which the BIOS ROMs were released expressed in BCD. The range is 01h to 52h.

HP BIOS I/O PORT MAP

This section describes the HP BIOS port map. The next section provides more details about how the BIOS uses the system board components mentioned in the I/O port list.

I/O Address Ports	Function	Bits
0000h - 000Fh	DMA controller 1	8
0020h - 0021h	Interrupt controller 1	8
0040h - 0043h	Interval timer 1	8
0060h, 0064h	Keyboard controller	8
0061h	NMI status and control	8
0070h	NMI mask register, RTC address and CMOS	8
0071h	RTC data and CMOS	8
0081h - 0083h, 008Fh	DMA low page register	8
0092h	Alternate reset and A20 Function	8
0096h - 009Fh	Internal ports	8
00A0h - 00A1h	Interrupt controller 2	8
00C0h - 00DFh	DMA controller 2	8
00EAh - 00EBh	Internal port	8
00F0h - 00FFh	Co-processor error	
0170h - 0177h	Secondary IDE controller	
01F0h - 01F7h	IDE controller	
0200h	Joystick port	
0220h - 0232h	Audio chip 1 (Soundblaster)	
0240h - 0252h	Audio chip 2 (Soundblaster)	
0260h - 0272h	Audio chip 3 (Soundblaster)	
0278h - 027Fh	Parallel port 2	
0280h - 0292h	Audio chip 4 (Soundblaster)	
02E8h - 02EFh	Serial port 4	
02F8h - 02FFh	Serial port 2	
0300h - 030Bh	MPU-401 1	
0330h - 033Bh	MPU-401 2	
0370h - 0371h	SMC 932 configuration	
0378h - 037Fh	Parallel port 1	
0388h - 038Bh	Ad-lib / FM	
03B0h - 03DFh	Video	
03E8h - 03EFh	Serial port 3	
03F0h - 03F7h	Flexible disk controller	
03F8h - 03FFh	Serial port 1	
0CF8h - 0CFFh	Used for PCI configuration*	

*These addresses are dedicated to configuration registers for PCI devices.

ADDRESSING SYSTEM BOARD COMPONENTS

This section provides more details of how the BIOS uses the system board components mentioned in the I/O port list.

DMA Channel Controllers

Only “I/O-to-memory” and “memory-to-I/O” transfers are allowed.“I/O-to-I/O” and “memory-to-memory” transfers are disallowed by the hardware configuration.

The system controller supports seven DMA channels, each with a pageregister used to extend the addressing range of the channel to 16 MB. The following table summarizes how the DMA channels are allocated.

First DMA controller (used for 8-bit transfers)	
Channel	**Function**
0	Available
1	SoundBlaster or ECP mode for parallel port
2	Flexible disk I/O
3	ECP mode for parallel port or SoundBlaster
Second DMA controller (used for 16-bit transfers)	
Channel	**Function**
4	Cascade from first DMA controller
5	SoundBlaster or Available
6	Available or SoundBlaster
7	Available

Interrupt Controllers

The system has two 8259A compatible interrupt controllers. They are arranged as a master interrupt controller and a slave that is cascaded through the master.

The following table shows how the master and slave controllers are connected. The Interrupt Requests (IRQ) are numbered sequentially, starting with the master controller, and followed by the slave.

IRQ (Interrupt Vector)		**Interrupt Request Description**
IRQ0(08h)		System Timer
IRQ1(09h)		Keyboard Controller
IRQ2(0Ah)	Slave IRQ	Cascade connection from INTC2 (Interrupt Controller 2)
	IRQ8(70h)	Real Time Clock
	IRQ9(71h)	Available for accessory board (ISA/PCI)
	IRQ10(72h)	SoundBlaster3, or Available for accessory board (ISA/PCI)
	IRQ11(73h)	Available for accessory board (ISA/PCI)
	IRQ12(74h)	Mouse, or ISA accessory board
	IRQ13(75h)	Co-processor
	IRQ14(76h)	IDE, or ISA accessory board
	IRQ15(77h)	2nd IDE or ISA/PCI accessory board

IRQ3(0Bh)		Serial Port 2, Serial Port 4, or ISA accessory board
IRQ4(0Ch)		Serial Port 1, Serial Port 3, or ISA accessory board
IRQ5(0Dh)		SoundBlaster1, Parallel Port 2, or ISA accessory board
IRQ6(0Eh)		Flexible Disk Controller
IRQ7(0Fh)		SoundBlaster2, Parallel Port 1, or ISA accessory board

Using the *Setup* program:

- IRQ3 can be made available by disabling serial ports 2 and 4.
- IRQ4 can be made available by disabling serial ports 1 and 3.
- IRQ5 can be made available by disabling the parallel port 2.
- IRQ7 can be made available by disabling parallel ports 1 and 2.
- IRQ12 can be made available by disabling the mouse interrupt.

PCI Interrupt Request Lines

PCI devices generate interrupt requests using up to four PCI interrupt request lines (INTA#, INTB#, INTC#, and INTD#).

When a PCI device makes an interrupt request, the request is re-directed to the system interrupt controller. The interrupt request will be re-directed to one of the IRQ lines made available for PCI devices.

All PCI devices with interrupt transfer support will use and share INTA#.A PCI device supporting multiple functionalities may use several INT lines. These devices will require more than one system interrupt request line.

5 POWER-ON SELF-TEST ROUTINES

This chapter summarizes the Power-On Self-Test (POST) routines. The first section indicates the order in which the tests are conducted. The second section lists the error codes which can be reported, along with theirmeanings. The third section summarizes the suggested corrective action appropriate for each error code.

VIEWED ON THE SCREEN

Each time the PC is turned on, or a reset is performed, the Power-On Self-Test (POST, also referred to as the *HP System Hardware Test*) is executed. The POST process verifies the basic functionality of the system components and initializes certain system parameters. It starts by displaying the initial “Vectra” screen. Although the POST routines are run as normal, their progress is not displayed (other than on the eight-stage graphics histogram underneath the “Vectra” label). If POST detects an error, the results are reported on a *View System Errors* screen.

During the POST, the BIOS and other ROM data is copied into high-speed *shadow RAM*, where it is addressed at the same physical location as the original ROM in a manner which is completely transparent to applications. This technique provides faster access to the system BIOS firmware.

If the POST is initiated by a soft reset [CTRL] [ALT] and [DELETE], the RAM tests are not executed and shadow RAM is not cleared. In all other respects, the POST executes in the same way following power-on or a soft reset.

The POST detects when a hard disk has been replaced, or if there have been changes in the size of the hard disk. However, it does not report an error.

The POST performs the tests in the order described here:

POST Test	**Description**
	System BIOS Tests
LED Test	Tests the LEDs on the control panel.
System (BIOS) ROM Test	Calculates an 8-bit check-sum. Test failure causes the boot process to abort.
RAM Refresh Timer Test	Tests the RAM refresh timer circuitry. Test failure causes the boot process to abort.
Interrupt RAM Test	1 Tests for RAM parity errors. 2 Checks the first 64 KB of system RAM used to store data corresponding to various system interrupt vector addresses. Test failures cause the boot process to abort.
Shadow the System ROM BIOS	Tests the system ROM BIOS and shadows it. Failure to shadow the ROM BIOS will cause an error code to display. The boot process will continue, but the system will execute from ROM. This tests is not performed after a soft reset (using [CTRL] [ALT] and [DELETE])
Load CMOS Memory	Checks the serial EEPROM and returns an error code if it has been corrupted. Copies the contents of the EEPROM into CMOS RAM.

CMOS RAM Test	Checks the CMOS RAM for start-up power loss, verifies the CMOS RAM checksum(s). Test failure causes error codes to display.
CPU Cache Memory Test	Tests the processor's cache memories. Test failure causes an error code to be displayed and the boot process to abort.
Video Tests	
Initialize the Video	Initializes the video subsystem, tests the video shadow RAM, and, if required, shadows the video BIOS. A failure causes an error code to display, but the boot process continues.
System Board Tests	
8042 Self-Test	Downloads the 8042 and invokes the 8042 internal self-test. A failure causes an error code to display.
Timer 0/Timer 2 Test	Tests Timer 0 and Timer 2. Test failure causes an error code to display.
DMA Subsystem Test	Checks the DMA controller registers. Test failure causes an error code to display.
Interrupt Controller Test	Tests the Interrupt masks, the master controller interrupt path (by forcing an IRQ0), and the industry-standard slave controller (by forcing an IRQ8). Test failure causes an error code to display.
Real-Time Clock Test	Checks the real-time clock registers and performs a test that ensures that the clock is running. Test failure causes an error code to display.
Audio Test	Tests that a SoundBlaster chip is present, and invokes a built-in self-test. Test failure causes an error code to display.
Memory Tests	
RAM Address Line Independence Test	Verifies the address independence of real-mode RAM (no address lines stuck together). Test failure causes an error code to display.
Size Extended Memory	Sizes and clears the protected mode (extended) memory and writes the value into CMOS bytes 30h and 31h. If the system fails to switch to protected mode, an error code is displayed.
Real-Mode Memory Test (First 640KB)	Read/write test on real-mode RAM. (This test is *not* done during a reset using [CTRL] [ALT] and [DELETE]). The test checks each block of system RAM to determine how much is present. Test failure of a 64 KB block of memory causes an error code to display, and the test is aborted.
Shadow RAM Test	Tests shadow RAM in 64 KB segments (except for segments beginning at A000h, B000h, and F000h). If they are *not* being used, segments C000h, D000h and E000h are tested. Test failure causes an error code to display.
Protected Mode RAM Test (Extended RAM)	Tests protected RAM in 64 KB segments (above 1 MB). (This test is *not* done during a reset using [CTRL] [ALT] and [DELETE]). Test failure causes an error code to display.

Keyboard / Mouse Tests	
Keyboard Test	Invokes a built-in keyboard self-test of the keyboard's microprocessor and tests for the presence of a keyboard and for stuck keyboard keys. Test failure causes an error code to display.
Mouse Test	If a mouse is present, invokes a built-in mouse self-test of the mouse's microprocessor and for stuck mouse buttons. Test failure causes an error code to display.
LAN Test	If the HP PCI Integrated 10/100 VG Interface is present, invokes a built-in self-test. Test failure causes an error code to display.
Tests of Flexible Disk Drive A	
Flexible Disk Controller Subsystem Test	Tests for proper operation of the flexible disk controller. Test failure causes an error code to display.
Coprocessor Tests	
Internal Numeric Coprocessor Test	Checks for proper operation of the numeric coprocessor part of the processor. Test failure causes an error code to display.
Communication Port Tests	
Parallel Port Test	Tests the integrated parallel port registers, as well as any other parallel ports. Test failure causes an error code to display.
Serial Port Test	Tests the integrated serial port registers, as well as any other serial ports. Test failure causes an error code to display.
Hard Disk Drive Tests	
Hard Disk Controller Subsystem Test	Tests for proper operation of the hard disk controller. Test failure causes an error code to display. The test does not detect hard disk replacement or changes in the size of the hard disk.
System Configuration Tests	
System Generation	Initiation of the system generation (SYSGEN) process, which compares the configuration information stored in the CMOS memory with the actual system. If a discrepancy is found, an error code will be displayed.
Plug and PlayConfiguration	Configures any Plug and Play device detected (either PCI or ISA): • All PCI devices, and any ISA device necessary for loading the operating system will be configured for use. • Any ISA device that is not required for loading the operating system, will be initialized (prepared for loading of a device driver), but not fully configured for use.

ERROR CODES

POST error codes are returned and, if possible, displayed when an error is detected during the execution of the power-on self-test procedures. As well as the four digit code number, the error message utility automatically displays an error diagnosis and suggestions for corrective action.

An exhaustive list of the error codes is given here, and a list of the suggested corrective actions is given in the next section. In order to use these lists, you need to find the appropriate four digit, hexadecimal, error code in the list below. These have been sorted into numerical order, to make it easy to find the appropriate entry. (In this, two dots are used to represent a range of values, such

as “4..7”, which means “4 or 5 or 6 or 7”, and the letter “x” is used to mean “any hexadecimal digit, 0..F”).

Underneath each error code, there is a short summary of the error diagnosis.

In order to find the suggested corrective action (SCA), it is necessary to read the five-character code that is given on the right of the error code. This SCA code can then be found in the list that is given in the next section of this chapter.

Not all of these error codes can be generated by the *HP Vectra XU 6/xxx PC* or *HP Vectra VT 6/xxx PC*. However, the complete list is given here, to allow for possible future changes to the models within this product line.

0000	An error of unspecified origin (no other error code was appropriate).	SCA24
000E	A thermal error occurred during your last session.	SCA33
0080..00DF	The ROM on an accessory board or the system board is corrupted.	SCA02
0110..011F, 0120	The real-time clock has failed.	SCA01
0130	The system date and time has not been entered or has been lost or corrupted.	SCA03
0240	The system configuration has been lost.	SCA04
0241, 0280	The system configuration has been lost or corrupted.	SCA04
0250	The *Setup* information does not match the hardware installed in the computer.	SCA05
02C0, 02C1	The master configuration information (stored in EEPROM) has been lost or corrupted	SCA04
02C2	The Plug and Play Configuration Information has been corrupted. Your adapters may not function correctly.	SCA30
02D0	The PC Serial Number is not set.	SCA27
0300..031F	The keyboard/mouse controller on the system board has failed.	SCA06
0342, 0352, 0354	The keyboard or its cable has failed.	SCA07
0343..0346, 0350, 0351, 0353, 0360	The keyboard or the keyboard controller on the system board has failed.	SCA06
03E0..03E4, 03EC	The mouse or the mouse controller on the system board has failed.	SCA06
03E5..03EB	The mouse has failed.	SCA08
0401	The system board has failed to switch to protected mode.	SCA01
0505	The system board's serial port has failed.	SCA09
0506	The built-in serial port's address is used by a serial port on an accessory board.	SCA10
0507	The system board's serial port at address 3F8h has failed.	SCA09
0508	The system board's serial port at address 2F8h has failed.	SCA09
0509	The system board's serial port at address 3E8h has failed.	SCA09
050A	The system board's serial port at address 2E8h has failed.	SCA09
0510	The infra red port has failed.	SCA26
0545	The system board's parallel port has failed.	SCA09
0546	The built-in parallel port's address is used by a parallel port on an accessory board.	SCA10

05F0	The built-in I/O controller's address is used by an accessory board. The following devices may not function properly: keyboard, mouse, serial and parallel ports, flexible disk drives, configuration information (serial EEPROM and CMOS RAM), real-time-clock, and configuration switches.	SCA34
0600..06FE	One of the keys on the keyboard is stuck or a key was pressed during the power-on self-test.	SCA11
06FF	The mouse is connected to the keyboard port.	SCA08
0700	The audio system cannot be initialized.	SCA04
0800	The ROM on an accessory board uses the same address (E000h) as the system board's boot ROM.	SCA12
0801	The boot ROM is enabled in *Setup* but a boot ROM is not present in the computer.	SCA13
0811	The Integrated Ethernet Interface cannot be found at the I/O base address specified in *Setup*.	SCA05
0812	The MAC address of the Integrated LAN Interface is corrupted.	SCA01
0813	The Integrated Ethernet Interface registers cannot be initialized.	SCA01
0814	The Integrated Ethernet Interface DMA transfer cannot be initialized.	SCA01
0815	The Integrated Ethernet Interface internal registers read and write test failed.	SCA05
0816	The Integrated Ethernet Interface configuration information is corrupted.	SCA04
0817	The EEPROM containing the configuration parameters of the LAN Interface is corrupted.	SCA32
081A	The Integrated Ethernet Interface internal loopback test failed.	SCA01
0900	The microprocessor fan is not connected. *** WARNING *** This could result in damage to the microprocessor!	SCA23
0910	The speaker is not connected.	SCA31
1100..110F, 1200..120F	The system board's timer has failed.	SCA01
20xA	Two different sized memory modules are in the same bank.	SCA35
201B, 202B, 204B, 208B	A memory error occurred during your last session.	SCA37
201C, 202C, 204C, 208C	Several memory errors occurred during your last session.	SCA38
2110..212F, 2210..221F	The system board's DMA controller has failed.	SCA01
4F00..4F0F	A memory module has failed.	SCA36A
6100..61FF, 6500, 8x06	A memory module or the system board has failed.	SCA14
62F1	The system board's memory controller has failed.	SCA01
6510, 6520	A memory module or the system board ROM has failed.	SCA25
65C0..65DF	Accessory board ROM(s) failed to be shadowed (copied) to RAM.	SCA16
6600..66FF	*Setup* information specifies a SCSI accessory board which is not detected inside the computer.	SCA16
6700	The parameters returned by the display do not match the DDC1 standard used by your PC for automatic set up of ergonomic refresh rates.	SCA29
7000..7FFF	The system board's interrupt controller has failed.	SCA01

8x03, 8x04	*Setup*'s custom-configured hard disk drive information is incorrect.	SCA05
8050	The built-in hard disk controller's address is used by a hard disk controller on an accessory board.	SCA19
8060	The system has detected that one or several IDE hard disks were added or removed since the PC was previously started (booted).	SCA18
8400	The hard disk drive's boot sector has been corrupted.	SCA20
9000..900F	Flexible disk drive A, its cable, or the controller has failed.	SCA17
9010	The built-in flexible disk controller's address is used by a flexible disk controller on an accessory board.	SCA19
9100..910F	The second flexible disk drive, its cable, or the controller has failed.	SCA17
9200..910F	The third flexible disk drive, its cable, or the controller has failed.	SCA17
A001	*Setup*'s co-processor information does not match the hardware installed in the computer.	SCA05
A002, A00C	The co-processor has failed.	SCA22
B300	The memory cache has failed.	SCA01
B320	The memory cache module has failed.	SCA28
E000..EFFF.	The RAM on an accessory board has failed.	SCA15

SUGGESTIONS FOR CORRECTIVE ACTION

An exhaustive list of the suggestions for corrective action (SCA) is given here, to accompany the list of the error codes that is given in the previous section. In order to find the suggested corrective action, it is necessary to read the five-character code that is given on the right of the error code in the previous section. This SCA code can then be found in the list in this section. These have been sorted into numerical order, to make it easy to find the appropriate entry.

SCA01

- Your system board may need to be replaced. Contact your service representative.

SCA02

1. Remove or disable the ROM(s) on the accessory board one by one to determine which one, if any, has failed.
2. If this fails to correct the problem, your system board may need to be replaced. Contact your service representative.

SCA03

- For models without a battery, this problem may occur if the PC is left unplugged for periods of 24 hours or more.
- For models with battery, replace the battery.
  1. Run *Setup* to correct the date and time information.
  2. If after running *Setup* the problem re-occurs even after a RESET or [CTRL] [ALT] [DELETE], ensure that the CONFG switch on the system board is set to Off.
  3. If all the above fail, your system board may need to be replaced. Contact your service representative.

SCA04

1. Run *Setup* to correct the configuration information.
2. If after running *Setup* the problem re-occurs even after a RESET or [CTRL] [ALT] [DELETE], ensure that the CONFG switch on the system board is set to Off.
3. If all the above fail, your system board may need to be replaced. Contact your service representative.

SCA05

1. Run *Setup* to view your configuration and correct any obvious errors.
2. If this fails to correct the problem, ensure that your hardware (accessory boards, disk drives, switches, and jumpers) is configured correctly (refer to their manuals). In particular, check that the CONFG switch on the system board is set to Off. Make a written note of the configuration before closing the cover.
3. If hardware settings were changed, run *Setup* to update the configuration information.

SCA06

1. If possible, test the keyboard and mouse by connecting them to a working Vectra 286, 386, or 486 computer:
2. If the working computer fails, the keyboard or mouse is defective.
3. If the error remains on this computer, or if you cannot test the keyboard and mouse, you may need to contact your service representative to determine if your system board needs replacement.

SCA07

1. Ensure the keyboard is firmly connected to the correct connector on the rear of the computer.
2. If the problem persists, your keyboard may need to be replaced. Contact your service representative.

SCA08

1. Ensure the mouse is firmly connected to the correct connector on the rear of the computer.
2. If the problem persists, your mouse may need to be replaced. Contact your service representative.

SCA09

- Your system board may need to be replaced. Contact your service representative.
- As a temporary solution, if you do not need the defective port, run *Setup* to disable it.

SCA10

- Either re-configure your accessory board or run *Setup* to re-configure your built-in port.

SCA11

1. Re-start your computer. Do not press a key during the power-on tests.
2. If the problem persists, check visually if a key is stuck on the keyboard and try to loosen it gently.
3. If this fails to correct the problem, your keyboard may need to be replaced. Contact your service representative.

SCA12

- Either re-configure or remove the accessory board ROM, or run *Setup* to disable the system board's boot ROM.

SCA13

1. If you do not need the boot ROM, run *Setup* to disable it.
2. If you need to use the boot ROM, run *HP6Init* to re-initialize it (refer to the manual).

SCA14

1. Ensure that all the memory modules are firmly seated in their sockets on the system board.
2. If the problem persists, your system board may need to be replaced. Contact your service representative.

SCA15

- Your accessory board or its memory may need to be replaced. Contact your service representative.

SCA16

1. Run *Setup* to disable SCSI BIOS ROM shadowing.
2. If this fails to correct the problem, your system board may need to be replaced. Contact your service representative.

SCA17

1. Run *Setup* to verify your configuration information. Correct it if necessary.
2. Ensure that all the disk cables are firmly connected.
3. If the problem persists, your disk drive or cable may need to be replaced. Contact your service representative.

SCA18

1. Run *Setup* to configure IDE hard disk drives:
   - if you have removed drive(s), confirm it by selecting the 'None or SCSI' field for the corresponding drive.
   - if you have added drive(s), confirm the new detected parameters by saving configuration with [F3].
2. If the hard disk configuration has not been modified, it is likely one of the drives has no longer been detected (in which case it was not identified on the POST screen).
3. Check cables are firmly plugged, and if the problem persists, contact your HP representative.

SCA19

- Either disable the disk controller on the accessory board or run *Setup* to disable the built-in disk controller.

SCA20

- Caution: this problem can be caused by a virus. See your reseller for anti-virus software.
  1. If you wish to save the data located on your disk drive, you should use a commercially available data recovery program.
  2. If you do not wish to save the data, re-format the hard disk (refer to the operating system manual).

SCA21

- Replace the microprocessor on the system board (refer to the manual).

SCA22

- Replace the co-processor on the system board (refer to the manual).

SCA23

- Please, turn off the unit until you have reconnected the microprocessor's fan to the system board (refer to the manual).
- If the problem persists, your fan may need to be replaced. Contact your service representative.

SCA24

- Contact your service representative.

SCA25

1. Ensure that all the memory modules are firmly seated in their sockets on the system board.
2. If this fails to correct the problem, run *HP6Init* to re- initialize the system board's ROM (refer to the manual).
3. If the problem persists, your system board may need to be replaced. Contact your service representative.

SCA26

- Your infrared interface may need to be replaced. Contact your service representative. As a temporary solution, if you do not need the defective infra red port, run *Setup* to disable it.

SCA27

1. Run *Setup* to enter the serial number of your system. You will find the Serial Number printed on the rear of the computer.
2. If this fails to correct the problem, your system board may need to be replaced. contact your service representative.

SCA28

1. Ensure that the memory cache module is firmly seated in its socket on the system board.
2. If this fails to correct the problem, your system board may need to be replaced. contact your service representative.

SCA29

- Run Setup to set the "Display Plug and Play" parameter to "Disabled" to avoid a blank screen at power on (or improper DMI recognition).

SCA30

1. Run *Setup* and the error will be corrected for you on [F3] exit.
2. If necessary, run your Plug and Play Configuration software to restore the information that was lost.
3. If the problem persists, a component may be defective. Contact your service representative.
4. You may also use the clear configuration switch, but you will have to re-initialize all your configuration with *Setup*.

SCA31

- Please, turn off the unit until you have reconnected the speaker to the system board (refer to the manual).
- If the problem persists, your speaker may need to be replaced. Contact your service representative.

SCA32

- Your LAN Interface may need to be replaced. Contact your service representative.

SCA33

1. Check that the fan air flow is not obstructed.
2. Check that the fan is well connected.
3. Run *Setup* to clear the error.

SCA34

- Re-configure your accessory board. Check your manual and *Setup* to see which resources are used by the internal devices.

Machine-Dependent Actions:

SCA35

- Replace the memory modules as follows:

Error code	Replace module in:
201A	Slot A or Slot B
202A	Slot C or Slot D
204A	Slot E or Slot F
208A	Slot G or Slot H

SCA36

- Replace the memory modules as follows:

Error code	Replace module in:
4F01	Slot A
4F02	Slot B
4F03	Slot C
4F04	Slot D
4F05	Slot E
4F06	Slot F
4F07	Slot G
4F08	Slot H

SCA37

- The memory error that was detected during the last session has been corrected. Run *Setup* to clear the error.
- If this message appears in the future again with the same error code, you should replace a memory module in that location:

Error code	Replace module in:
201B	Slot A1 or Slot A2
202B	Slot B1 or Slot B2
204B	Slot C1 or Slot C2
208B	Slot D1 or Slot D2

SCA38

- One of the memory modules must be replaced.
  The following table indicates the location:

Error code	Replace module in:
201C	Slot A1 or Slot A2
202C	Slot B1 or Slot B2
204C	Slot C1 or Slot C2
208C	Slot D1 or Slot D2

- Run *Setup* to clear the error.